



Presented to:

Army Corrosion Summit

Army Aviation Corrosion Engineering Case Studies

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Date: 10 February 2010

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Development and Engineering Center**

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- **Introduction**
- **H-47 FRIES Bar Support Rod Corrosion**
- **H-60 SAS Link SCC Failure**

- **AMC**
 - **RDECOM**
 - **AMRDEC**
 - **AED**
 - » **Structures and Materials Division**
 - » **Materials Branch**
 - » **Corrosion and Environmental Team**

- **Core Competencies**
 - **Coatings**
 - **Corrosion**
 - **Sealants**
 - **Adhesives**
 - **NDI**
 - **Operational Chemicals and Processes**
 - **Environmental Issues**
- **Customer Base**
 - **Aviation PMOs**
 - **Corrosion Program Office**
 - **Environmental Technology Integration Group**

- **Problem**



- A Category I Quality Deficiency Report (QDR) investigation of the FWD Fast Rope Insertion Extraction (FRIES)/External Rescue Hoist support rod (P/N LEX-1583-05), consisting of microscopic, ultrasound, and metallurgic examination revealed severe corrosion of the inside surface of the rod. Subsequent investigation of additional ship sets revealed several support rods within the FWD FRIES/External Rescue Hoist truss assembly exhibiting similar corrosion.

- **The Investigation**
- Multiple bars were dissected and inspected
- Structural analysis to determine effect of corrosion loss
- Conformance of hardware to the drawings?
- Categorized severity

Interior view of severely corroded Support Rod



- **Resolution**
- ASAM H-47-09-ASAM-04 is issued
- Requires inspection and grading of the corrosion severity
- Thoroughly dry the rod and treat interior with MIL-C-16173, Grade 3
- Restrict usage of the FRIES station based on corrosion severity

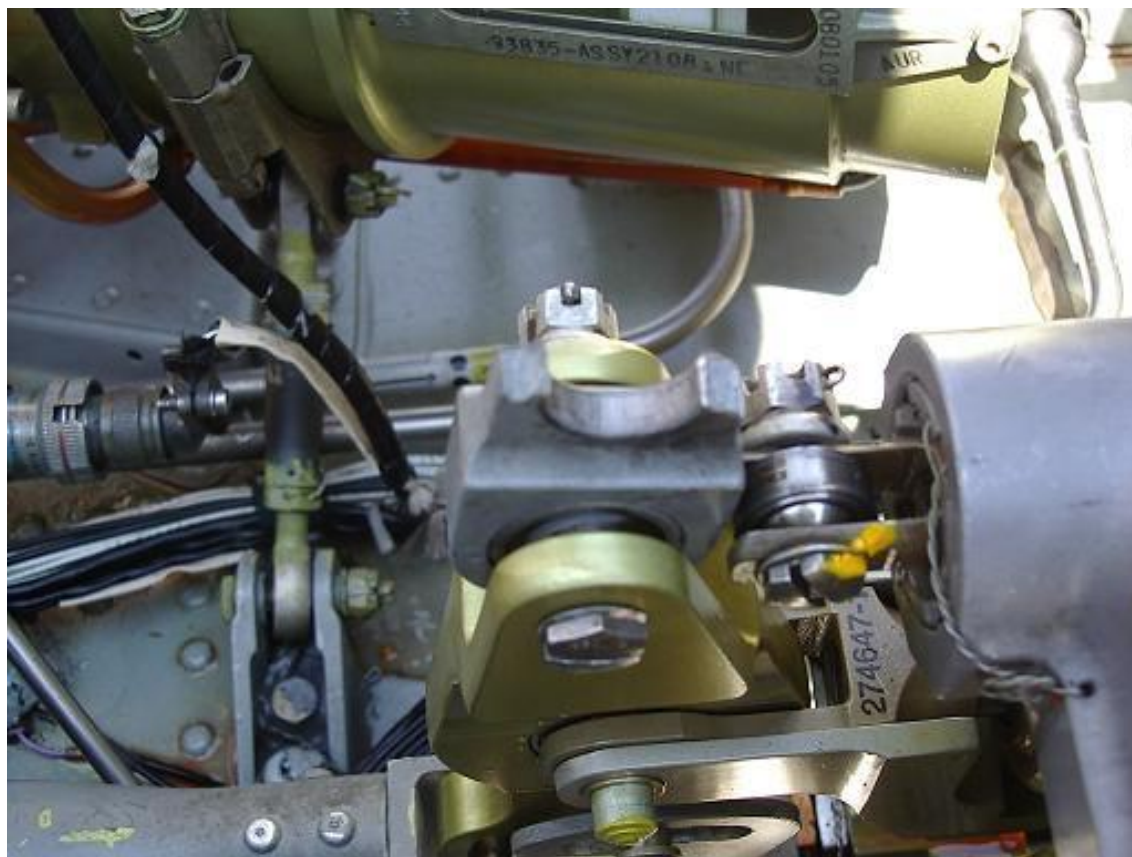
Example of rod end threads of a seized in place rod end. Notice the extent of the corrosion and pitting



- Result – The rest of the story
- Aircraft were restricted until support rods were replaced
- All support rods have been replaced
- The old rods have been scrapped



- **The Problem**
- During ground taxi of a Navy aircraft, it would not turn right despite full right pedal input. Inspection of the aircraft revealed the Stability Augmentation System (SAS) Link, PN 70410-02334-044, on the Yaw Boost Servo was fractured. Analysis determined that the Link failed due to Stress Corrosion Cracking (SCC), and indicated the material to be 7075-T6 Temper.



H-60 SAS Link

Problem: HS-11 reported that during preflight flight control checks, pilot noticed a thump. Pilot continued with preflight checks and noted that all flight controls felt normal and that the anomaly did not return. During ground taxi aircraft would not turn right despite full right pedal input. The aircraft was shutdown at which time the SAS Link, P/N 70410-02334-044, on Yaw Boost Servo, P/N 70410-22910-045, was found fractured.

Cause: Lab analysis determined that the link failed due to stress corrosion cracking (SCC) through its cross section. Subsequent to this failure, the link further fractured due to overload. Hardness and conductivity testing indicate a -T6 temper condition which has poor resistance to SCC. Newer SAS Links (-045) are manufactured in the -T73 temper condition which is less susceptible to SCC. However, drawing for older SAS Links (-044) allows manufacture in the T-6 temper condition. SAS Link is used on Yaw and Collective Boost Servo Assemblies (P/N 70410-22910-045) and Pitch and Roll Trim Assemblies (P/Ns 70410-22760-050/-051/-053).

Risk Assessment: HRI = 12. Medium Safety Risk

- Severity: Catastrophic (1).
- Frequency: Improbable (E).

Required Action: Bulletin for one-time inspection:

- Inspect for and remove all -044 SAS Links .
- Inspection to be conducted either visually if link p/n is legible or via eddy current conductivity testing if p/n is not legible.

Compliance time: NLT next 56 Day Special

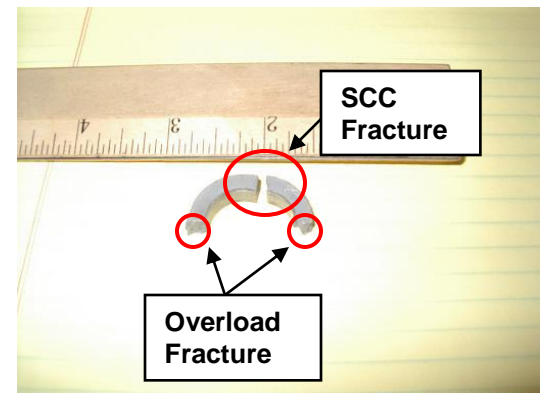
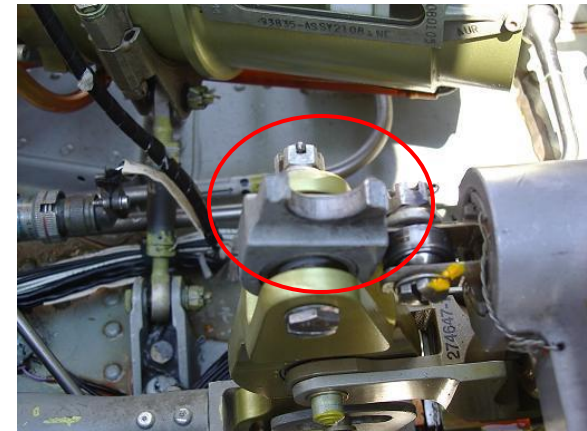
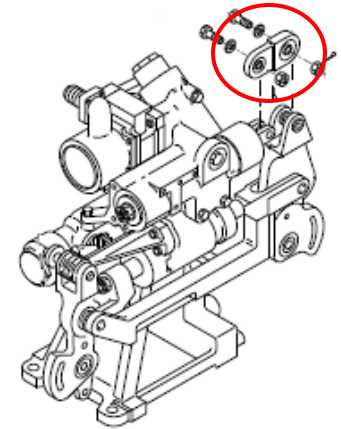
Application: All Naval H-60 aircraft

Supply Data:

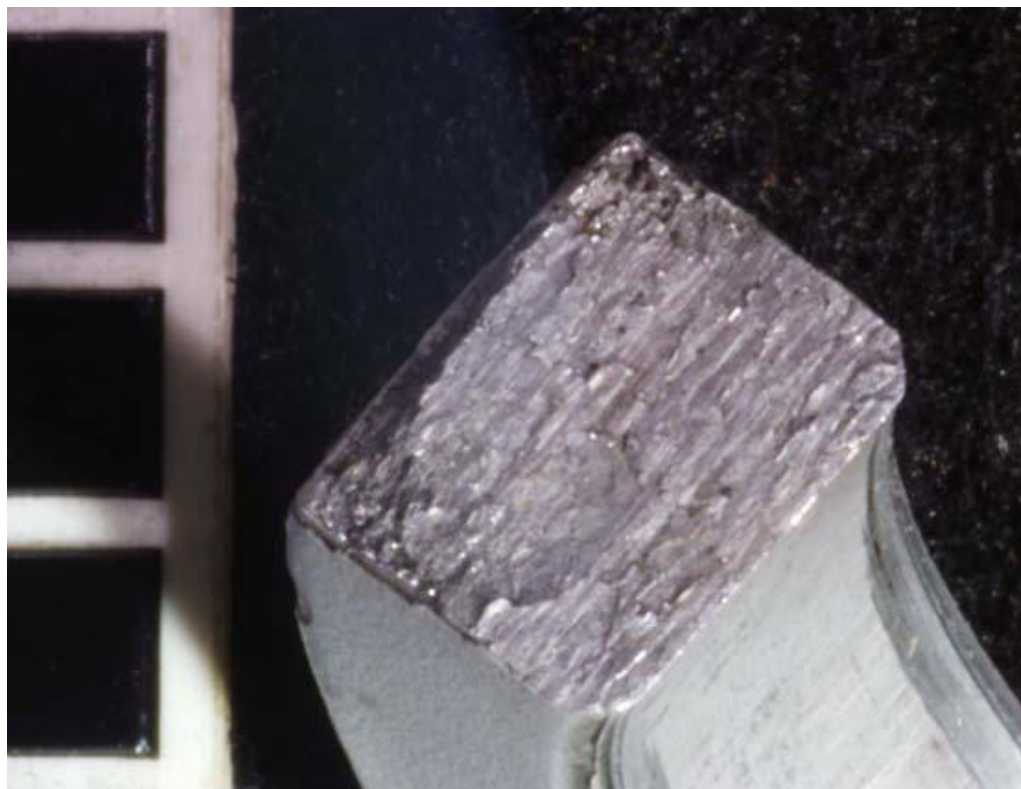
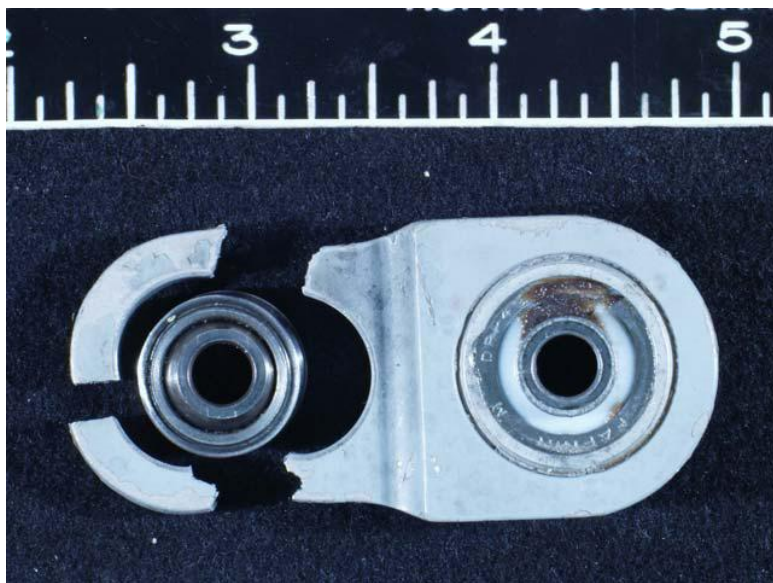
- Bulletin is logistically supportable.
- 157 SAS Link Assemblies, P/N 70410-02334-045, on hand.

Follow-On Action:

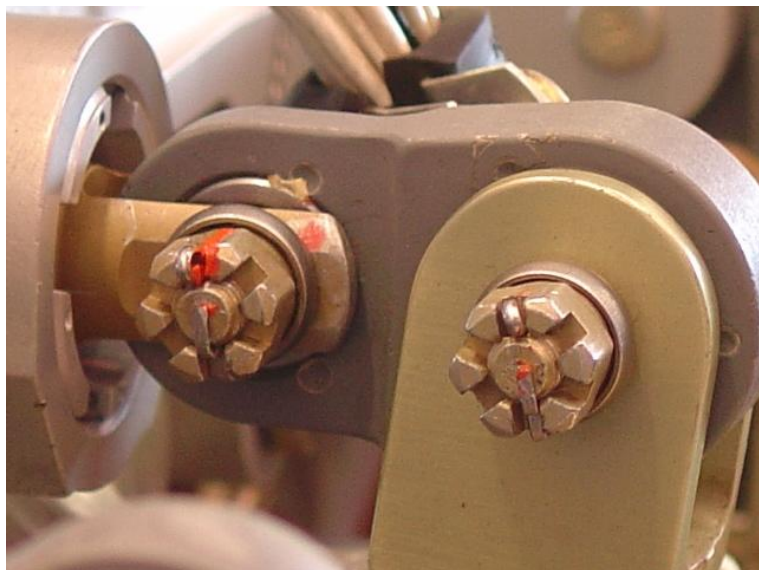
- Ensure all SAS Link Assemblies, P/N 70410-02334-044, are purged from supply system.
- Ensure references to SAS Link Assembly, P/N 70410-02334-044, are removed from applicable manuals.



- **The Investigation**
- Drawing review – the link was not to print
 - 7075-T651 versus 7075-T73
 - Press fit versus adhesive and staked
- Structural Analysis
- Failure Analysis
- Risk Analysis



- **The Resolution**
- Issue a message H060-10-ASAM-04
- Inspect all subject links for evidence of corrosion
- Conductivity check to determine alloy
- Touch up and apply CPC MIL-C-81309 Type II
- Ongoing inspections of T6 links



- The Outcome
- As of 13 Jan, 1052 aircraft, 3165 links inspected
- 999 links failed (T6)
- 362 Aircraft with new links



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